Ashford and St. Peter's Hospitals
NHS Foundation Trust

Paediatric Myocarditis Guideline

Author: Dr Praneeth Vedagiri

Supervisor: Dr Alexandra Jones
Dr Alison Groves

Contact details: p.vedagiri1@nhs.net, alison.groves1@nhs.net

Guideline History		
Date	**Comments**	**Approved By**
Jan 2012	First Development of Guideline	Paediatric guideline committee.
May 2020	Review. No changes	Paediatric Guideline Committee
October 2025.	Addition of current pathways, flow charts and management in line with STRS	Paediatric Guideline Committee

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Paediatric Myocarditis – Approach to Diagnosis and Management

Introduction

- This guideline relates to the management of Paediatric Myocarditis
- The aim is to provide a guideline to recognition, investigation and management of Paediatric Myocarditis, it's complications and advice regarding intubation.
- This guideline also navigates clinicians to the appropriate referral and follow-up pathways.

Presentation

Suspect myocarditis if viral illness + symptoms of heart failure + persistent tachycardia + abnormal CXR or ECG

Consider myocarditis in any child with history/clinical signs of:

- Respiratory:
  - Distress without clinical evidence of sepsis or infective cause
  - Presumed chest infection failing to improve on appropriate treatment
- Cardiac failure:
  - Symptoms – Fatigue, poor feeding, SOB/IWOB
  - Signs - Poor peripheral perfusion (weak pulses, cool extremities, prolonged capillary refill) without appropriate explanation (e.g. diarrhoea, vomiting, reduced oral intake). Displaced apex beat, S3 gallop rhythm, raised JVP, pulmonary oedema, hepatomegaly, peripheral oedema, ascites
- Arrhythmia:
  - Palpitations +/- syncope
  - ECG findings
- Shock presenting with abdominal pain, vomiting, tachycardia, narrow pulse pressure and hypotension

Investigations

1st line:

- CXR:
  - Cardiomegaly, pericardial effusion, pulmonary oedema, pleural effusions, interstitial infiltrates
- ECG:
  - **Cardinal feature: persistent tachycardia**
  - ST elevation (most common), T-wave changes, any tachy- or brady-arrythmias
- Bloods – Essential:
  - Gas - Look for metabolic acidosis
  - FBC, CRP, U&E, LFT, TFTs
  - Cardiac enzymes (Troponin, AST, CK, BNP)
    - Perform if high index of suspicion
    - If raised needs admission with subsequent urgent echo/specialist assessment
  - Blood culture
  - More common viral serology: coxsackie, adenovirus, SARS-CoV-2

2nd line:

- Bloods – consider:
  - Less common viral serology: EBV, CMV, Parvovirus B19. Less commonly HSV, Hep B, Hep C, Borrelia serology
  - ASOT
  - Mycoplasma PCR
  - Genetic & metabolic screen
  - Ferritin
  - Antibody screen – ANA, ANCA, ACE, anti-dDNA
- Throat swab
- Urgent ECHO:
  - Ventricular function, pericardial effusion, valve regurgitation, regional wall abnormalities, rule out other causes of cardiac failure (e.g. ALCAPA)

Management

Mainly supportive

Targets:

- Early involvement of:
  - 1st – STRS
  - 2nd – Cardiology at Evelina
  - 3rd – Dr Groves/Dr Otunla for Echo
  - 4th – PID at SGH
  - For referral pathways, see **Page 6**

- Nursing suggestion: careful input/output monitoring, BP and daily weights

Management Pathways:

Initial management: **Involve paediatric cardiology and STRS early**
- Supplemental oxygen to maintain saturations >90%
- Continuous cardiac and observation monitoring
- CPAP as temporising measure:
  - Reasoning: positive pressure ventilation aids LV function and reduces metabolic demand
- Treat underlying pathogen if suspected/identified

If acutely unwell:

Shock without pulmonary oedema:
- Trial of cautious fluid resuscitation
- Titrate to HR, BP, CRT, lactate, end-organ perfusion
- Reassess – stop if worsening respiratory status or hepatomegaly

Decompensated Heart Failure/Cardiogenic shock:
1. Intensive HF management:
2. Positive pressure ventilation (PPV)
3. Mechanical support

(See below)

If asymptomatic or mildly symptomatic:
- Oral diuretics - loop diuretics and aldosterone antagonists
- ACEi (afterload reducing action) + B-blockers + Nitrites
- NB: Oral heart failure therapy should be initiated once the patient is beyond the acute stage of illness and shows persistent systolic dysfunction or heart failure

Decompensated Heart Failure/Cardiogenic shock:

Intensive HF management:

- IV furosemide 0.5mg-1mg/kg (max initial dose 20mg)
- Inotropes:
  - Milrinone is inotrope of choice (caution in hypotension and risk of causing myocardial irritation) - improves cardiac output without O2 demand
  - Initially 0.5mcg/kg/min but further afterload reduction can be considered by increasing up to 1mcg/kg/min or levosimendan is alternative (senior decision)

Positive Pressure Ventilation (PPV):

- Aim:
  - Improve cardiac function by reducing work of breathing, reducing left ventricular afterload, and increasing systemic O2 levels
- BiPAP or intubation

Mechanical Support:

ECMO

Intubation

- Indications:
  - persistent desaturation
  - unresponsive hypotension
  - reduced consciousness or senior decision
- Induction is high risk due to:
  - Endogenous sympathetic response
  - Sudden drop in SVR/BP
  - Pulmonary oedema risk
- Start peripheral low dose adrenaline infusion (0.02-0.1mcg/kg/min) prior to induction.
  - Caution: higher doses of adrenaline may cause tachycardia, arrhythmias, vasoconstriction
- Use small doses of cardio-stable anaesthetic drugs (fentanyl 1-2mcg/kg, ketamine 1mg/kg and rocuronium 1mg/kg)
- Ideally sedate with morphine/clonidine infusion +/- muscle relaxation if intubated.
  - Caution with midazolam/propofol
- Have resuscitation drugs and defibrillator on standby

Follow-up

- Follow up - when back to normal activity, RAC follow up 6 weeks.
- Local cardiology follow-up to be discussed with Dr Groves/Dr Otunla +/- need for cardiac MRI at the RBH/Evelina

Additional Notes

- If severe viral myocarditis:
    - High dose corticosteroids + IVIg improves outcomes (Liaise with PID)
- Immune-mediated disease (e.g. PIMS-TS) – corticosteroids/immunomodulators
- May need specialised mechanical support/ECMO

Referral Pathways

Cardiology at Evelina:

- For emergency and urgent referrals first contact the on-call paediatric cardiology registrar through switchboard on 020 7188 7188
    - If advised by the registrar, complete the urgent cardiology referral form and email it to gst-tr.urgentevelinapaedcardreferral@nhs.net.
- For routine referrals: complete the routine cardiology referral form (Word 245KB) and emailing it to gst-tr.elchpaedcardioreferrals@nhs.net.

Paediatric Infectious Diseases at St George's:

- On-call registrar via switchboard on 020 8672 1255

For Dr Groves – email: alison.groves1@nhs.net

For Dr Otunla – email: tosin.otunla@nhs.net

2. Supporting References

1. Evalina Myocarditis/Cardiomyopathy guidelines: https://www.evelinalondon.nhs.uk/resources/our-services/hospital/south-thames-retrieval-service/Myocarditis.pdf
2. Pompa AG, Beerman LB, Feingold B, Arora G. Electrocardiogram changes in pediatric patients with myocarditis. Am J Emerg Med. 2022 Sep;59:49-53. doi: 10.1016/j.ajem.2022.06.027. Epub 2022 Jun 17. PMID: 35779288.
3. Alamri AS, Khayat LT, Alzahrani AJ, Kurdi LK, Alkhameesi NF, Bahaidarah SA. Clinical Presentation of Myocarditis in the Pediatric Age Group and Predictors of Poor Early and Late Outcomes: Academic Hospital Experience. Cureus. 2022 Nov 18;14(11):e31643. doi: 10.7759/cureus.31643. PMID: 36540482; PMCID: PMC9760052.
4. Myocarditis. Indian academy of Paediatrics. Available at: https://iapindia.org/pdf/Ch-076-Myocarditis.pdf.
5. Murakoshi, Y., Hoshino, K. Treatment strategy for acute myocarditis in pediatric patients requiring emergency intervention. BMC Pediatr 23, 384 (2023). https://doi.org/10.1186/s12887-023-04200-0
6. https://www.uptodate.com/contents/treatment-and-prognosis-of-myocarditis-in-children

3. Supporting relevant trust guidelines

Sepsis guidelines

2. Guideline Governance

a. Scope

This guideline is relevant to all staff caring for all children from 0-18 years old across the emergency department, inpatient ward and outpatient department.

b. Purpose

i. This guidelines aims to facilitate a common approach to the management of children. At times deviation from the guideline may be necessary, this should be documented and is the responsibility of the attending consultant.

ii. This guideline is subject to regular review to ensure ongoing evidence based practice.

c. Duties and Responsibilities

All healthcare professionals responsible for the care of all children 0-18years should be aware of practice according to this guideline.

d. Approval and Ratification

This guideline will be approved and ratified by the Paediatric Guidelines Group.

e. Dissemination and Implementation

i. This guideline will be uploaded to the trust intranet 'Paediatric Guidelines' page and thus available for common use.
ii. This guideline will be shared as part of ongoing education within the Paediatric Department for both medical and nursing staff.
iii. All members of staff are invited to attend and give comments on the guideline as part of the ratification process.

f. Review and Revision Arrangements

a. This policy will be reviewed on a 3 yearly basis by the appropriate persons.
b. If new information comes to light prior to the review date, an earlier review will be prompted.
c. Amendments to the document shall be clearly marked on the document control sheet and the updated version uploaded to the intranet. Minor amendments will be ratified through the Paediatric Guidelines Group. A minor amendment would consist of no major change in process, and includes but is not limited to, amendments to documents within the appendices.

g. Equality Impact Assessment

Background • Who was involved in the Equality Impact Assessment
Author and the supervising consultants.
Methodology • A brief account of how the likely effects of the policy was assessed (to include race and ethnic origin, disability, gender, culture, religion or belief, sexual orientation, age) • The data sources and any other information used • The consultation that was carried out (who, why and how?)
All groups of staff and patients were taken into consideration and there is no bias towards or against any particular group.
Key Findings • Describe the results of the assessment • Identify if there is adverse or a potentially adverse impacts for any equalities groups
There is no evidence of discrimination.
Conclusion • Provide a summary of the overall conclusions
There is no evidence of discrimination.
Recommendations • State recommended changes to the proposed policy as a result of the impact assessment • Where it has not been possible to amend the policy, provide the detail of any actions that have been identified • Describe the plans for reviewing the assessment
This guideline is appropriate for use.

h. Document Checklist

To be completed (electronically) and attached to any document which guides practice when submitted to the appropriate committee for approval or ratification.

Title of the document: Paediatric Myocarditis Guideline

Policy (document) Author: Praneeth Vedagiri

Executive Director: N/A

		Yes/No/ Unsure/NA	Comments
1.	**Title**		
	Is the title clear and unambiguous?	**Y**	
	Is it clear whether the document is a guideline, policy, protocol or standard?	**Y**	
2.	**Scope/Purpose**		
	Is the target population clear and unambiguous?	**Y**	
	Is the purpose of the document clear?	**Y**	
	Are the intended outcomes described?	**Y**	
	Are the statements clear and unambiguous?	**Y**	
3.	**Development Process**		
	Is there evidence of engagement with stakeholders and users?	**Y**	
	Who was engaged in a review of the document (list committees/ individuals)?	**Y**	**Paed guidelines committee, Cardiology network – RBH and Evelina. STRS**
	Has the policy template been followed (i.e. is the format correct)?	**Y**	
4.	**Evidence Base**		
	Is the type of evidence to support the document identified explicitly?	**Y**	

		Yes/No/ Unsure/NA	Comments
	Are local/organisational supporting documents referenced?	**Y**	
5.	**Approval**		
	Does the document identify which committee/group will approve/ratify it?	**Y**	
	If appropriate, have the joint human resources/staff side committee (or equivalent) approved the document?	**N/A**	
6.	**Dissemination and Implementation**		
	Is there an outline/plan to identify how this will be done?	**Y**	
	Does the plan include the necessary training/support to ensure compliance?	**Y**	
7.	**Process for Monitoring Compliance**		
	Are there measurable standards or KPIs to support monitoring compliance of the document?	**Y**	
8.	**Review Date**		
	Is the review date identified and is this acceptable?	**Y**	**3 years**
9.	**Overall Responsibility for the Document**		
	Is it clear who will be responsible for coordinating the dissemination, implementation and review of the documentation?	**Y**	
10.	**Equality Impact Assessment (EIA)**		
	Has a suitable EIA been completed?	Y	

Committee Approval (Paediatric Guidelines Group)			
If the committee is happy to approve this document, please complete the section below, date it and return it to the Policy (document) Owner			
Name of Chair	**Alexandra Jones**	**Date**	**17/10/2025**
Ratification by Management Executive (if appropriate)			
If the Management Executive is happy to ratify this document, please complete the date of ratification below and advise the Policy (document) Owner			
Date: n/a			